Data User Guide

Mobile UIUC Soundings IMPACTS

Introduction

The Mobile UIUC Soundings IMPACTS dataset consists of atmospheric sounding data collected by rawinsondes launched during the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) field campaign. These data include vertical profiles of atmospheric temperature, relative humidity, pressure, wind speed, and wind direction. Specifically, these rawinsondes were provided by the University of Illinois at Urbana-Champaign (UIUC). IMPACTS was a three-year sequence of winter season deployments conducted to study snowstorms over the U.S Atlantic Coast. The campaign aimed to (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. The sounding data files are available in netCDF-4 format from January 18 through February 25, 2022, though it should be noted that this dataset will be updated in subsequent years of the IMPACTS campaign.

Citation

Rauber, Robert, Andrew Janiszeski, Troy Zaremba, and Megan Varcie. 2020. Mobile UIUC Soundings IMPACTS [indicate subset used]. Dataset available online from the NASA Global Hydrometeorology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/IMPACTS/SOUNDING/DATA101

Keywords:

NASA, GHRC, IMPACTS, UIUC, atmospheric sounding, radiosonde, rawinsonde

Campaign

The Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS), funded by NASA's Earth Venture program, is the first comprehensive study of East Coast snowstorms in 30 years. IMPACTS will fly a complementary suite of remote sensing and in-situ instruments for three 6-week deployments (2020-2022) on NASA's ER-2 high-altitude aircraft and P-3 cloud-sampling aircraft. The first deployment began on January 17, 2020 and ended on March 1, 2020. The second deployment was from January through March 2022. IMPACTS samples U.S. East Coast winter storms using advanced radar, LiDAR, and microwave radiometer remote sensing instruments on the ER-2 and state-of-the-art microphysics probes and dropsonde capabilities on the P-3, augmented by ground-based radar and rawinsonde data, multiple NASA and NOAA satellites (including GPM, GOES-16, and other polar orbiting satellite systems), and computer simulations. IMPACTS addressed three specific objectives: (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. More information is available from [NASA's Earth Science Project Office's IMPACTS field campaign webpage].

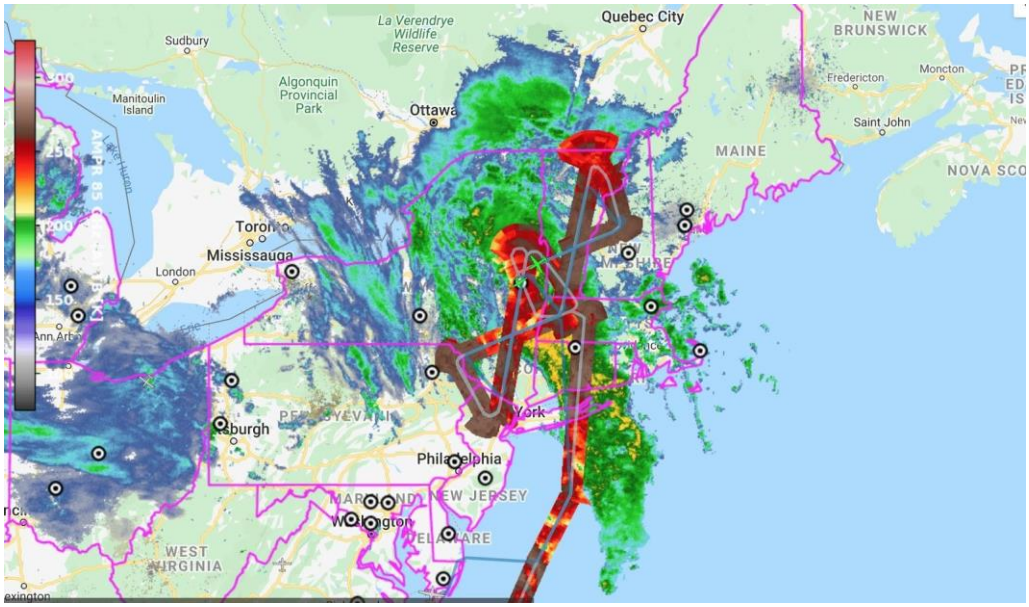

Figure 1: IMPACTS field campaign operations on January 25, 2020 with plots of ER-2 and P-3 flight tracks in addition to ground radar sites and radar reflectivity over the region (Image source: Dr. Timothy Lang, NASA MSFC)

Instrument Description

The University of Illinois at Urbana-Champaign (UIUC) mobile sounding sites were used to launch iMet-4 Radiosondes during the IMPACTS campaign. These radiosondes, technically referred to as rawinsondes when they can be tracked to obtain wind information, provide

vertical atmospheric profiles of temperature, pressure, relative humidity, windspeed, and wind direction. The rawinsonde is attached to a sounding balloon that lifts the device from the surface through the atmosphere. The sounding balloon can ascend to over 12 km in altitude. The rawinsonde consists of temperature, pressure, and humidity sensors along with a GPS receiver. The rawinsonde GPS data are used to calculate wind speed, wind direction, and pressure once the rawinsonde reaches a certain height. As the rawinsonde rises through the atmosphere, the sounding systems are receiving and processing the data. The rawinsonde transmits data every 1 second. These data are received by an antenna that is connected to a computer where the data are stored. More information about the iMet-4 Radiosonde is available in the iMet-4 Radiosonde Data Sheet. More information about rawinsondes in general is available on the NWS Radiosonde webpage. The sites used to launch soundings during the IMPACTS field campaign are listed in Table 1 below.

Table 1: Sounding site locations

Site	Latitude	Longitude
Vestal, NY	42.096	-75.974
Rutland, VT	43.584	-72.967
Liverpool, NY	43.102	-76.189
Ticonderoga, NY	44.262	-73.441
White River Junction, NY	43.646	-72.335
Urbana, IL	40.116	-88.243
Geneseo, NY	42.800	-77.814
Plymouth, PA	41.959	-70.671
Albany, NY	42.687	-73.853
Vernon, CT	41.824	-72.502
Plattsburgh, NY	44.695	-73.500
Urbana, IL	40.116	-88.253

Investigators

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Data Characteristics

The Mobile UIUC Soundings IMPACTS dataset consists of atmospheric sounding data stored in netCDF-4 format. Each file contains one sounding and the data are available at a Level 2 processing level. More information about the NASA data processing levels is available on the EOSDIS Data Processing Levels webpage. The characteristics of this dataset are listed in Table 2 below.

Table 2: Data Characteristics

Characteristic	Description
Platform	Ground-based Mobile Sounding Site
Instrument	Rawinsonde
Spatial Coverage	N: 44.705, S: 40.106, E: -70.661, W: -88.253 (United States)
Spatial Resolution	~ 5 meters
Temporal Coverage	January 18, 2020 - February 25, 2022
Temporal Resolution	1 hour -< 1 day
Sampling Frequency	1 second
Parameter	Temperature, relative humidity, pressure, wind speed and direction
Version	1
Processing Level	2

File Naming Convention

The Mobile UIUC Soundings IMPACTS dataset files are stored in netCDF-4 format and named using the following convention:

Data files: IMPACTS_UIUC_Mobile_research_sounding_YYYYMMDD_hhmm.nc

Table 3: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
.nc	netCDF-4 file format

Data Format and Parameters

The Mobile UIUC Soundings IMPACTS dataset files contain atmospheric sounding data in netCDF-4 format. The attribute information contained in each file includes latitude, longitude, start time, institution, and starting altitude (meters above MSL). Each data field and description is listed in Table 4 below.

Table 4: Data Fields for netCDF-4 Sounding files

Field Name	Description	Data Type	Unit
TC	Temperature	float64	Degrees C
RH	Relative humidity	float64	%
Time	Time in seconds past launch	timedelta64[ns]	ns
HAGL	Height above ground level	float64	m
WINDSPD	Windspeed	float64	m/s
PRESS	Pressure	float64	mb
WINDDRN	Wind direction	float64	degrees

Note: Surface winds were approximated by the UIUC students at the launch location for all launch sites except Urbana, IL. For the Urbana, IL launches, the previous hourly wind observations at the KCMI weather station were used.

Algorithm

A rawinsonde is attached to a sounding balloon that lifts the sonde through the atmosphere. The rawinsonde uses its sensors to measure temperature, relative humidity, and pressure as it rises. The wind data are calculated using the rawinsonde GPS receiver. In the lower atmosphere, the rawinsonde's pressure sensor measures the surrounding atmospheric pressure. However, after the sonde ascends above a certain level, the GPS altitude, temperature, and humidity data are used to derive the instrument's pressure level in the atmosphere. More information about the iMet-4 Radiosonde is available in the iMet-4 Radiosonde Data Sheet.

Quality Assessment

The rawinsondes undergo a ground check prior to launch to verify that temperature, relative humidity, and settings for the rawinsonde are properly referencing ground measurements. The iMet-4 Radiosondes had an accuracy of ± 0.2 °C for temperature, ± 0.5 m s^{-1} for wind, and ± 5% for relative humidity. The iMet-4 temperature and humidity sensors were calibrated to meet National Institute of Standards and Technology (NIST) standards. More details about iMet-4 Radiosonde measurements is available in the iMet-4 Radiosonde Data Sheet.

Software

This dataset is in netCDF-4 format and does not require any specific software to read. However, the data are easily readable and viewed in Panoply.

Known Issues or Missing Data

There are no known issues with these data or any known gaps in the dataset.

References

International Met Systems. (2006). iMet-4 Radiosonde: 403 MHz GPS Synoptic Technical Data Sheet.
https://www.intermetsystems.com/ee/pdf/202084-11_iMet-4_Technical_Data_Sheet.pdf

National Weather Service. Radiosonde Observations.
https://www.weather.gov/upperair/factsheet

National Weather Service. Radiosondes.
https://www.weather.gov/jetstream/radiosondes

Varcie, Megan M., Troy J. Zaremba, Robert M. Rauber, et al. 2022: Precipitation Growth Processes in the Comma Head Region of the 7 February 2020 Northeast Snowstorm: results from IMPACTS, *Journal of the Atmospheric Sciences*. https://doi.org/10.1175/JAS-D-22-0118.1

Related Data

All other datasets collected as part of the IMPACTS campaign are considered related and can be located by searching the term "IMPACTS" in the GHRC HyDRO2.0 search tool.

Contact Information

To order these data or for further information, please contact:

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